

# California Academy of Sciences' Academy

Member Newsletter

April & May 2004

## Downtown Aquarium and Natural History Museum Opens May 1, 2004

In 1874, the Academy opened San Francisco's first public museum on the corner of California and Dupont (now Grant Avenue). It later moved to larger premises on Market Street in 1891. However, after the 1906 earthquake and fires, the museum was relocated to Golden Gate Park. Now, as the Academy prepares to rebuild its aging facilities in the park, it will once again open a public museum in downtown San Francisco – this time at 875 Howard Street between 4th and 5th Streets. This downtown facility, which will house aquarium and natural history exhibits as well as the Academy's research operations, will open to the public in May 2004. "We are all looking forward to opening our doors to the public once again," said Terrence Gosliner, Ph.D., Provost and Senior Curator at the Academy. "We will use our time at Howard Street to experiment with new ideas and technology that could enhance our future facility in Golden Gate Park, and we welcome your feedback about everything from our new exhibits to the new cafe."

Among the new exhibits will be a suite of new aquarium displays, which will include nearly 6,000 Steinhart Aquarium animals. Many of the fish will be housed

in familiar jewel tanks, but others will move into larger homes. A 20,000-gallon, two-story coral reef tank will hold the aquarium's corals and tropical reef fish (see page 6 for details). The penguins will also get a larger tank, which will enable visitors to view the birds both on land and underwater. Additionally, a series of round tanks that measure up to twenty feet in diameter will hold groups of animals that share the same type of habitat. These tanks will be equipped with acrylic panels that allow for "top-to-bottom" viewing.

After the Academy unveils these new aquarium displays, it will once again be open to the public every day, from 10 am until 5 pm. Before the grand opening, be sure to come by during our Members' Preview of Howard Street. Exclusively for members, there will be two separate days to preview the Academy at Howard Street on Wednesday, April 28 and Friday, April 30 (see page 4 for details). For more information about the Howard Street facility, including maps and directions, see page 8.



## New ANTS Exhibit is the Perfect ANTidote for Dull Days

Audiences everywhere are ANTicipating the arrival of the fANTastic natural history exhibit that will be featured at the Academy's new Howard Street facility – *ANTS: Hidden Worlds Revealed*. Curated by Academy entomologist Brian Fisher, Ph.D., this exciting exhibit will showcase six colonies of live ants, each of which will display distinctive nest building and food collecting behaviors. Four of the species represented – Harvester ants, Carpenter ants, Honey Pot ants, and invasive Argentine ants – are commonly found in California. The other two species, however, come from further afield. Leaf Cutter ants, which cultivate gardens of fungus in order to ensure a steady food supply, make their home in the tropical rain forests of South America, while meat-eating Army ants migrate through parts of Africa and the Americas in search of prey.

Each of the six live ant colonies will offer visitors the chance to look inside the chambers and tunnels of the ants' nests and watch them forage for food. The most dramatic views will be of the Army ants, which have never before been displayed in a large-scale exhibit. These amazing ants build nests out of their own bodies by interlocking their tarsal claws to form intricate, tunnel-filled cylinders that are over three feet wide. The interior corridors and chambers of these living nests can be opened or closed according to climatic need, and the temperature can be controlled within a single degree Fahrenheit. Army ants also display unique foraging behaviors – they hunt by forming a fan-shaped swarm and devouring every animal in their path. In the *ANTS* exhibit, the Academy's Army ants will march across a bed of sand three times a day to prey on live crickets. The feeding show will feature live narration from an Academy biologist and up-close footage from two video cameras



within the enclosure.

In addition to the live ant colonies, *ANTS* will also feature cutting-edge research by Academy scientists, including Brian Fisher's work in Madagascar. In the past few years, Fisher has discovered over 600 new species of ants in Madagascar, including the Madagascar Dracula ant – a find that will help scientists to understand the evolution of ants from wasps. Named because of their grisly feeding habits, during which they cut holes into their own larvae to extract colorless insect blood, Dracula ants have wasp-like abdomens and stinging behaviors.

The exhibit will also feature Academy research that is occurring closer to home, including the Bay Area Ant Survey, which will give visitors the opportunity to contribute to an ongoing Academy research project. Visitors who wish to participate can pick up an ant collecting kit from the Academy's Naturalist Center (located on the second floor of the Howard Street facility). After collecting specimens and returning them to the Academy along with geographic data, each participant's results will be added to the project map and Web site, which will be available online at [www.antweb.org](http://www.antweb.org).



PHOTO: ALEX WILD © 2004

### Come Visit Us On Opening Day: May 1

Join the Welcoming Committee, meet Howard the Gi-ANT, and blow bubbles on your way to the Academy's new location at 875 Howard Street! There will be lots to do as the Academy celebrates its Grand Opening on May 1 and 2. Find out more about upcoming activities on page 5.

## Message to Members



PHOTO: DON GONG

Patrick Kocielek, Ph.D.

When the Academy reopens to the public in May 2004, it will be a dynamic and exhilarating place to visit. Yes, it will be a little more compact than the Academy that you are used to, but there will be much to stimulate the mind and the senses. Of course, members of the Academy will not have to wait quite that long. We will have special opening days for members on **Wednesday, April 28** and **Friday, April 30**. That is when you will have the chance to see a new and different Steinhart Aquarium – although largely filled with familiar creatures – and our two special exhibits: *ANTS* and *Astrobiology*.

**ANTS: Hidden Worlds Revealed** will include six colonies of live ants, including Army ants and Leaf Cutter ants brought here

from overseas with special permits. The insects will be displayed in a series of specially built enclosures where you can view their fascinating activities up close.

**Astrobiology: Life in the Extreme** focuses on extremophiles, those species that have adapted to the harshest environments on Earth and whose survival modes may mirror those of any life forms that may exist elsewhere in the Universe.

The Academy has gone to great efforts and considerable expense to ensure there is continuity during the period of closure in Golden Gate Park while a new Academy is being rebuilt on the old site. This decision was made in part so as not to disrupt the staff and not to disappoint you, our members and most enthusiastic visitors, but primarily to ensure that the public as a whole and the schoolchildren of the Bay Area, in particular, will have a natural history museum and an aquarium where they can learn about and, we hope, be inspired by the beauty and importance of the natural world.

I look forward to greeting you soon, down on Howard Street.

— Patrick Kocielek,  
Executive Director

## 19th Annual BioForum

### Life in Extreme Environments: A Window to the Universe

Does life exist elsewhere in the Universe? Scientists in the field of astrobiology look beyond our Goldilocks world that is “not too hot and not too cold” to investigate extreme environments such as marine hydrothermal vents and desert hot springs. They are also researching the “extremophiles,” or organisms that survive in these harsh places, to learn more about life beyond Earth. Scientists share what they have learned about the extremes of life on Earth and the implications of their findings.

**Saturday, April 24, 9 am–12:30 pm, Registration starts at 8:15 am**  
**Oakland Museum of California; \$15 members & non-members, \$10 students**  
**Tickets can be purchased by calling (415) 750-7145 or**  
**by downloading a registration form at**  
**[www.calacademy.org/education/bioforum/bioforum2003-2004/2003-2004.html](http://www.calacademy.org/education/bioforum/bioforum2003-2004/2003-2004.html)**.

**What is it?** BioForum, now in its nineteenth year, is a series on current science topics of interest to educators.

**Who attends?** Most attendees are high school science teachers; however, a number of middle school science teachers, community college teachers, docents, student teachers and interested members of the public attend as well.

**Where is it held?** This year, BioForum is co-hosted by the California Academy of Sciences and Oakland Museum of California. Note that the April 24th BioForum will be held at the Oakland Museum of California in Oakland.

#### Moderator:

**Peter D. Roopnarine, Ph.D.**  
Assistant Curator and Department Chair,  
Invertebrate Zoology and Geology,  
California Academy of Sciences

#### Speakers:

**Carol Tang, Ph.D.**  
*Escargot and Extremophiles:  
Food Webs in Desert Springs*  
Senior Science Educator and Research  
Associate, California Academy of Sciences

#### Deborah S. Kelley, Ph.D.

*Some Like It Hot and Deep: Extremophiles  
of the Thermal Vents*  
Associate Professor, School of  
Oceanography, University of Washington

**Additional speaker to be announced**

## Junior Academy

### Spring Break

#### Spring Explorations For Ages 9–12

From plankton to sea lions, meet San Francisco's urban wildlife and learn how they survive in the city. Investigate and understand food chains and adaptations as you do hands-on activities with Academy naturalists. New: Drop-off and pick up at the field locations. Directions and other information provided with course confirmation.



#### Pier Dwellers

Experience the wild world living on and under the San Francisco waterfront piers. Observe and learn about behaviors of marine mammals and local seabirds. Touch the secret underwater creatures that live below the surface of our oceans, and see what makes these “spineless wonders” unique. Class for children ages 9–12.

**Thursday, April 15, 8:30 am–noon; \$35 members, \$45 non-members.**

#### Wetland Wonders

Spend the morning at Crissy Field wetland observing migratory birds, uncovering sand crabs, and assisting in a restoration project. Discover how Native Americans used local plants in their day-to-day environment and how this tidal marsh was transformed from trash to treasure. Class for children ages 9–12.

**Friday, April 16, 8:30 am–noon; \$35 members, \$45 non-members.**

**i** Please call (415) 750-7145, e-mail [edregistrar@calacademy.org](mailto:edregistrar@calacademy.org), or visit [www.calacademy.org/education/course\\_catalog](http://www.calacademy.org/education/course_catalog) for more information, including class descriptions and a registration form.

### Family Dinosaur Adventure

Share a learning adventure with your family on this specially crafted fossil expedition in western Colorado's red-rock country this summer. **Field Trip for Families with Children Ages 7 and Up: Saturday, July 24–Friday, July 30; \$1,289–\$2,365 members, \$1,364–\$2,440 non-members. (Transportation, accommodations, and meals are included; airfare is not.)**

**i** For more information, please call the Academy Travel Office at (800) 853-9372 or e-mail [calacademy@hcptravel.com](mailto:calacademy@hcptravel.com).

### Summer Camp

#### Summer Explorations For Ages 6–8

Classes take place at the Academy's downtown location. Each class is scheduled from **8:30 am–noon; \$35 members, \$45 non-members.**

**Tidepool Creatures – Monday, July 26**

**Herptacular – Tuesday, July 27**

**Arthropods Alive – Wednesday, July 28**

**Birdmania – Thursday, July 29**



#### Overnight Adventures

Transportation to and from the Academy at Howard Street is provided. All meals, except lunch on the first day of the trip, are included.

**Wild Woodland Adventurers at Pepperwood for Ages 9–12**

**June 18 (orientation) & 21–23; \$325 members, \$375 non-members.**

**Marine Biology Adventurers at Bodega for Ages 12–14**

**August 6 (orientation) & August 9–13; \$510 members, \$560 non-members.**

Scholarships based on financial need are available for all Junior Academy classes. Call (415) 750-7145 for an application or visit [www.calacademy.org/education](http://www.calacademy.org/education) to download a form.

### Adult Nature Journaling Workshop in the Trinity Alps

Always wanted to keep an illustrated journal or try your hand at watercolor? Spend three relaxing days nurturing your artistic nature at the Academy's property in the Trinity Alps, about three hours northwest of Redding. **Field Workshop for Adults: Thursday, July 15–Sunday, July 18, 6 pm Thursday–2 pm Sunday \$175 members, \$200 non-members. (Accommodations and meals are included; transportation is not.)**

**i** For more information, please contact Lorie Topinka, Manager of Teacher Services, at (415) 750-7145 or e-mail [teacherservices@calacademy.org](mailto:teacherservices@calacademy.org).

# LECTURES

We are pleased to inform you that the lecture series and all of its core components will continue throughout the Academy's transition. However, since the Howard Street facility does not have an auditorium, the lectures will be hosted at off-site venues. All venues are easily accessible through public transportation and offer viable parking options. Thank you in advance for your continued support of the Academy's exciting lecture programs.

## Special Lecture at the Jewish Community Center of San Francisco

### The Evolution of Human Skin Coloration

**Nina Jablonski, Ph.D., Irvine Chair & Curator, Department of Anthropology, California Academy of Sciences**

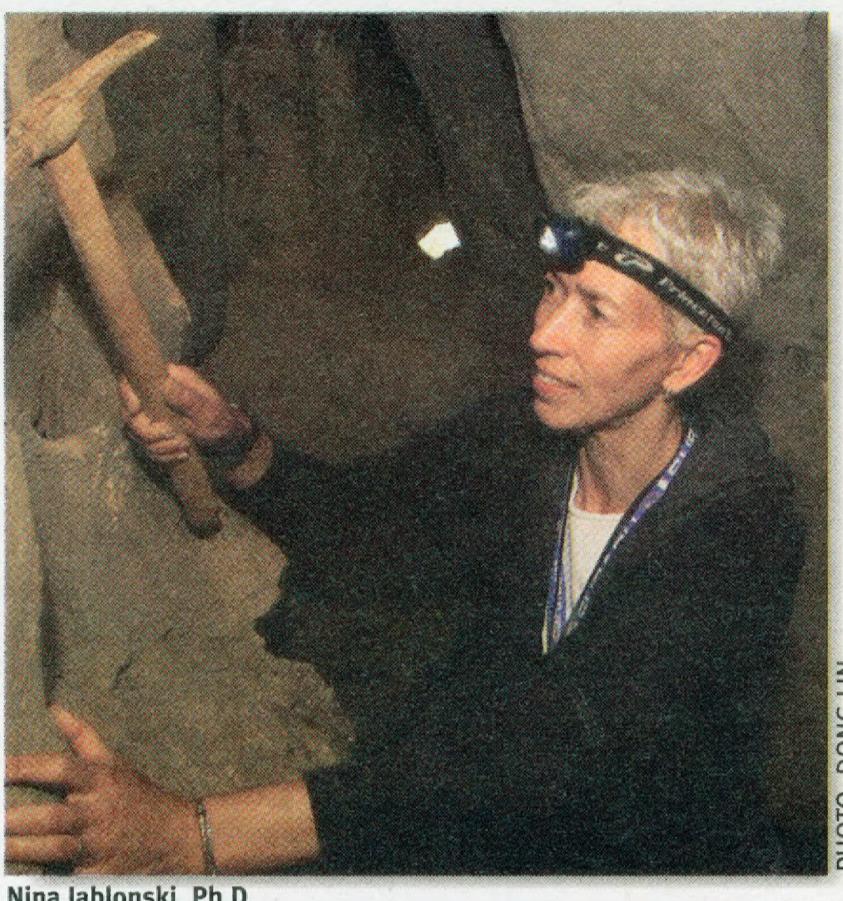
Though human skin is not preserved in the fossil record and we have little direct evidence of its evolution, it has long been recognized that the distribution of skin colors among native peoples is not random. New evidence from the fields of epidemiology and physiology, analyzed in conjunction with remotely-sensed environmental data, clearly indicates that the worldwide pattern of human skin color is a product of natural selection acting to regulate the penetration of ultraviolet radiation into the skin. The level of melanin pigmentation in human skin represents a compromise between the demands of photoprotection and vitamin D synthesis, both of which are essential for survival and successful reproduction.

**Thursday, April 29, 7:30 pm**

**Jewish Community Center of San Francisco**

**\$6 members & students, \$8 non-members**

**Tickets can be purchased by calling the JCCSF Box Office at (415) 292-1233 or e-mailing arts@jccsf.org. Tickets can be also be purchased at the door, when available.**



Nina Jablonski, Ph.D.

## Jewish Community Center of San Francisco

**3200 California Street at Presidio Avenue, San Francisco**

### Public Transportation

The following MUNI bus lines stop directly in front: #1 California, #3 Jackson, #4 Sutter, #43 Masonic

### Parking is available at the following locations:

- Beneath the JCCSF in the building's garage.
- The UCSF Laurel Heights campus parking lot, accessible from Walnut and California Streets.

## Zeum Theater

**221 4th Street at Howard Street, San Francisco**

### Public Transportation

BART & MUNI – disembark at the Powell Street Station. Exit to 4th and Market Streets. Head northeast on 4th Street for two blocks. Turn left on Howard Street.

### Parking is available at the following locations:

- The 5th and Mission Garage, on Mission Street between 4th and 5th Streets.
- The Moscone Garage, on 3rd Street between Howard and Folsom Streets.

## Academy Members' Lectures at Zeum Theater

### The Earth Moved: On the Remarkable Achievements of Earthworms

**Amy Stewart, author**

With Darwin as her inspiration, Stewart explores the lifecycle and habits of earthworms, uncovering the complex life that exists beneath our feet. The earthworm may be small, spineless, and blind, but its role in the ecosystem is profound. It tills the soil, destroys microscopic organisms that cause plant disease, breaks down toxins, and turns soil into rich compost, creating the most fertile areas on Earth. Stewart will bring a variety of worms to the lecture and participants will have the opportunity to handle several species of earthworms and learn about each species' unique role in the soil. See a book review in the Spring 2004 issue of *California Wild*.



Amy Stewart

**Monday, April 19, 2 & 7:30 pm  
Zeum Theater  
Free to members,  
\$4 Zeum members,  
\$8 non-members  
Tickets can be purchased on page 5 or at the door.**

### Empire of the Ants

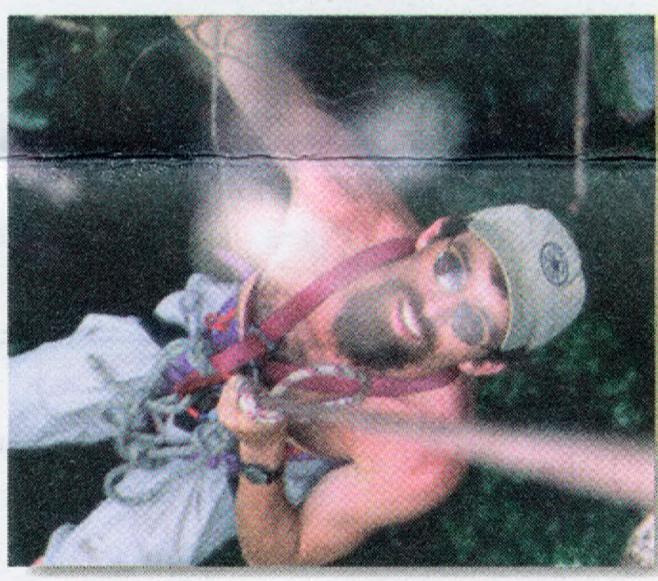
**Brian Fisher, Ph.D.**

**Assistant Curator, Department of Entomology, California Academy of Sciences**

Explore the fascinating world of ants through the scientist's eyes whose work led to the new *ANTS* exhibit at the Academy's Howard Street facility.

*ANTS: Hidden Worlds Revealed* features a live Army ant colony

that is the first of its kind and size to be housed outside of the tropics. In addition to being one of the most aggressive insect species, with the



Brian Fisher, Ph.D.

ability to hunt down and devour prey, the Army ant also has a magnificent capacity for social cooperation. Join Fisher as he shares the adventures of procuring the colony from Trinidad and the challenges inherent in housing a colony of 500,000 to 2 million ants that requires an estimated 3,000 crickets a day for food.

**Monday, May 17, 2 & 7:30 pm; Zeum Theater  
Free to members, \$4 Zeum members,  
\$8 non-members; Tickets can be purchased on page 5 or at the door.**

## Conversations at the Herbst Theatre

**2004**

**Presented by City Arts & Lectures, Inc.  
All Programs at Herbst Theatre, 8 pm**

**April 7 Wednesday Simon Winchester**

Writer

*Krakatoa, The Professor and the Madman  
The Map That Changed the World*  
In conversation with Michael Krasny

**April 13 Tuesday Eric Schlosser**

Investigative Reporter

*Fast Food Nation*  
In conversation with Jerry Lowenstein, Ph.D.

**April 28 Wednesday Paul Ekman, Ph.D.**

Professor of Psychology, UC San Francisco  
*Emotions Revealed, Telling Lies*  
In conversation with Nina Jablonski, Ph.D.

**May 26 Wednesday Diane Ackerman**

Naturalist, Poet

*An Alchemy of Mind, Cultivating Delight  
A Natural History of the Senses*  
In conversation with Angie Coiro

**The Annual Claire Matzger Lilienthal Distinguished Lecturer**

**June 2 Wednesday Julie Gerberding, M.D.**

Director, Center for Disease Control and Prevention

In conversation with Paul Volberding, M.D.

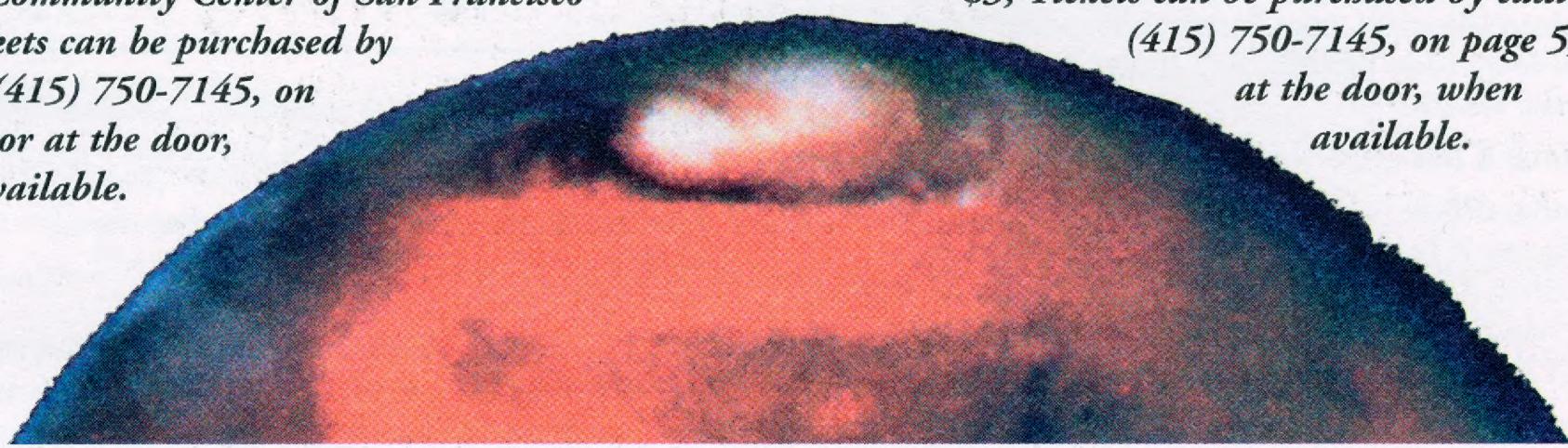
Lecture: \$16 members, \$18 non-members  
Series: \$90 members, \$102 non-members

To order tickets, please call City Box Office at (415) 392-4400 or visit [www.cityboxoffice.com](http://www.cityboxoffice.com)

California Academy of Sciences does not process ticket orders for these lectures.

This series is made possible, in part, by a grant from the Richard and Rhoda Goldman Fund.

**Monday, April 12, 7:30–9 pm  
Jewish Community Center of San Francisco  
\$3; Tickets can be purchased by calling (415) 750-7145, on page 5, or at the door, when available.**



# 4 APRIL

## 7 WEDNESDAY

### **Conversations at the Herbst Theatre**

Featuring Simon Winchester. See page 3 for details. To order tickets, call City Box Office at (415) 392-4400 or visit [www.cityboxoffice.com](http://www.cityboxoffice.com). 8 pm; \$16 members, \$18 non-members; Herbst Theatre.

## 9 FRIDAY

### **Spring Bird Watching**

Search for spring migrants and resident birds in Golden Gate Park. Wear warm, layered clothing and walking shoes, and bring binoculars and water. Ages 8 and up. Reservations required; space limited. 9–11:30 am; Free; Meet at the corner of Middle Drive Road and 9th Avenue. Rain cancels program.

## 10 SATURDAY

### **Easter Program**

The Academy is co-sponsoring a program of Easter events at COPIA – the Center for Wine, Food, and the Arts in Napa. See panel to right for more information. noon–4 pm; \$7.50 Academy members, \$12.50 non-members; COPIA, Napa, California.

## 12 MONDAY

### **Mars-like Soils in the Atacama Desert**

Benjamin Dean lecture with Chris McKay, Ph.D. See page 3 for information. See page 5 for tickets. Tickets can also be purchased at the door, when available. 7:30–9 pm; \$3; JCCSF.

## 13 TUESDAY

### **Conversations at the Herbst Theatre**

Featuring Eric Schlosser. See page 3 for details. To order tickets, call City Box Office at (415) 392-4400 or visit [www.cityboxoffice.com](http://www.cityboxoffice.com). 8 pm; \$16 members, \$18 non-members; Herbst Theatre.

## 14 WEDNESDAY

### **Mountain Lake and Beyond**

Pre-registration required for this class for children ages 9–12. See page 2 for information. 8:30 am–noon; \$35 members, \$45 non-members.

## 15 THURSDAY

### **Pier Dwellers**

Pre-registration required for this class for children ages 9–12. See page 2 for information. 8:30 am–noon; \$35 members, \$45 non-members.

## 16 FRIDAY

### **Wetland Wonders**

Pre-registration required for this class for children ages 9–12. See page 2 for information. 8:30 am–noon; \$35 members, \$45 non-members.

## 18 SUNDAY

### **Family Discovery Hike**

Take a spring walk around Golden Gate Park and look for hawks, turtles, millipedes, dragonflies, and more. Wear warm, layered clothing and walking shoes, and bring binoculars and water. Ages 8 and up. Reservations required; space limited. 10 am–noon; Free; Meet at the corner of Middle Drive Road and 9th Avenue. Rain cancels program.

## 19 MONDAY

### **The Earth Moved**

Members' lecture with Amy Stewart. See page 3 for information. See page 5 for tickets or at the door. 2 & 7:30 pm; Free to members, \$4 Zeum members, \$8 non-members; Zeum Theater.

## 24 SATURDAY

### **19th Annual BioForum**

Life in Extreme Environments: A Window to the Universe. See page 2 for information. Reservations required. 9 am–12:30 pm, Registration starts at 8:15 am; \$15 member & non-members, \$10 students; Oakland Museum of California.

## 28 WEDNESDAY

### **Members' Preview of Howard Street**

Academy members whose last names start with the letters A–K are invited to a special preview of the Academy at Howard Street. (See page 8 for directions.) Be one of the first to see the Academy before opening day. 10 am–7 pm; Free to Academy members only. Sorry, no guests.

### **Conversations at the Herbst Theatre**

Featuring Paul Ekman, Ph.D. See page 3 for details. To order tickets, call City Box Office at (415) 392-4400 or visit [www.cityboxoffice.com](http://www.cityboxoffice.com). 8 pm; \$16 members, \$18 non-members; Herbst Theatre.

## 29 THURSDAY

### **The Evolution of Human Skin Coloration**

Special lecture with Nina Jablonski, Ph.D. See page 3 for information. For tickets, call the JCCSF Box Office at (415) 292-1233 or e-mail [arts@jccsf.org](mailto:arts@jccsf.org). Tickets can also be purchased at the door, when available. 7:30 pm; \$6 members & students, \$8 non-members; JCCSF.

## 30 FRIDAY

### **Members' Preview of Howard Street**

Academy members whose last names start with the letters L–Z are invited to a special preview of the Academy at Howard Street. (See page 8 for directions.) Be one of the first to see the Academy before opening day. 10 am–7 pm; Free to Academy members only. Sorry, no guests.

### **MEMBER INFORMATION**

ACADEMY OPENS AT 875 HOWARD STREET MAY 1, 2004.

Open 365 days a year. Hours everyday: 10 am–5 pm

Information Hotline: (415) 750-7145

Web site: [www.calacademy.org](http://www.calacademy.org)

E-mail: [info@calacademy.org](mailto:info@calacademy.org)

Public Programs: (415) 750-7143

Lectures: (415) 750-7096

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Library: (415) 750-7102

Education: (415) 750-7100

# Academy

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# Traditional Arts Programs

The Traditional Arts Program is funded by the Paul L. and Phyllis Wattis Foundation. For further information about Traditional Arts Programs, visit [www.calacademy.org](http://www.calacademy.org).

## Easter Program

The Academy is co-sponsoring a program of Easter events at COPIA: The American Center for Wine, Food, and the Arts in Napa. The program features Andrey Anisimov painting Russian icons on hardwood eggs, Alberta Astras etching eggs in the Lithuanian style, Giedra Gusta using leaf stencils and vegetable dyes to make Lithuanian *marguciai*, and Joan Bridges using a wax-resist technique to make Ukrainian *pysanky*. The Academy presentations are part of a larger Spring Festival that includes family activities, games, and egg races.

**i** Saturday, April 10, noon–4 pm; All events take place at COPIA in Napa, and are free after general admission; \$7.50 Academy members, \$12.50 non-members; For directions and information, call COPIA toll-free at (888) 512-6742, or visit their Web site at [www.copia.org](http://www.copia.org).

## Asian Pacific Heritage Month

In collaboration with the Asian Cultural Center in Oakland's Chinatown, the Academy celebrates Asian Pacific Heritage Month with two traditional art presentations.

**Saturday, May 8, noon–4 pm** - Artists from the local Tongan community demonstrate the ancient process of making tapa cloth (*ngatu*) – a textile created by pounding thin layers of mulberry tree bark with wooden mallets and painting the surface with typical Tongan designs. Other activities scheduled during the afternoon include: Polynesian food; Chinese music and calligraphy; the art of carving vegetables into animal and plant shapes; photographic exhibits on Asian immigration in California; seminars on Asian cultures; and classes on tai chi and feng shui.

**Saturday, May 15, 4 pm** - The Cook Islands Maori Cultural Society performs music and dance from Rarotonga. The program opens with rhythmic chants, followed by a drum dance (*ura pau*) and an action song (*kapa rima*). Instruments include wooden drums and slit gongs (*pate*), bongos (*pau mango*), bass drum (*pau*), conch shell (*pu*), and strings (*ukarere*). The program ends with audience participation.

**i** These programs take place at the Oakland Asian Cultural Center. For directions and information, call (510) 637-0455 or visit their Web site at [www.oacc.cc](http://www.oacc.cc). Admission to all Oakland Asian Cultural Center programs are free to the public.

## Sign up for Academy Bytes . . .

Want the latest information about 875 Howard Street? Need reminders for upcoming events like classes, lectures, and field trips? Get this and more in a monthly e-newsletter all about Academy events. Send an e-mail to [info@calacademy.org](mailto:info@calacademy.org) with "Academy Bytes" in the subject line.

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General Information: (415) 750-7145

# Opening Weekend

## Saturday, May 1 & Sunday, May 2

The Academy's Countdown to Downtown is almost over! Join us as we celebrate the opening of our new location on Saturday and Sunday, May 1 and 2 – the ants will be busy building nests, the fish will be swimming in their swank new tanks, and the Academy's Howard Street building will be bursting at the seams with special programs and activities for kids of all ages. All opening weekend festivities are free with museum admission.

### March with Howard the Gi-ANT

Join Howard, a huggable costumed ant, as he leads a Welcoming Committee on a mini-march from Yerba Buena Gardens to 875 Howard Street. As a member of the welcoming committee, you'll receive fun party favors, including ant antennae, bubbles, and whistles. Reservations required by Thursday, April 29 – call (415) 750-7144. *10:00 am Saturday*

### Touch Tide Pool

Explore a California tide pool with Academy interns. Touch your favorite live animals in the newly-designed touch tide pool. *10 am–5 pm both days*

### Orientation to the Naturalist Center

Open for Drop-In Orientation. Stop in to say hello and check out the wonderful resources available to you! *10 am–5 pm both days*

### Festive Face Painting

Want to look like you have been to the big event? Early visitors will have the opportunity to have quality face painting for a limited time. *10:30–11:30 am Saturday*

### Highlight Tours

Docents lead tours that explore our new aquarium and two of our newest exhibits, ANTS and Astrobiology. *10:15 & 11:15 am both days*

### Children's Story Time

Stories highlighting Asian Pacific Islander Heritage Month. For children ages 3–7. *10:30 am both days*

### Introduction to the Bay Area Ant Survey

Meet with Academy scientists and learn how to participate in this unique scientific study. *12:30–12:45 pm & 2:30–2:45 pm both days*

### Ant Antennae

Ants have most wonderful feelers! Pick up your own pair of pipe cleaner ant antennae in the Nature Nest. *1–5 pm both days*

### Japanese Origami

Vicky Mihara leads a workshop on Japanese origami. All materials provided. Make your own origami butterfly to take home. *1 pm Saturday*

### Fish Stories

Storyteller Richard Standard will enchant visitors with a repertoire of tales that include some "fishy" stories to celebrate the opening of the new aquarium.

*1 pm Sunday*

### Making Comets

Using dry ice, Academy docents will discuss what a comet is made of, their orbits, and how we are able to see them. This demo steams, bubbles, and gurgles in simulation of what we think a comet might do.

*2 pm both days*

### DNA Extraction

Watch and learn as interns spin vegetables to reveal their DNA and discuss the code of life. Interns will teach visitors about the importance and relevance of studying genes. *3 pm both days*

### Carpenter Ants Facilitation

Ants have complicated communication tricks. Check out the visible scent trails with Academy Educator, Lorie Topinka at the Carpenter ants display.

*3–5 pm Sunday*

# MAY

## 8 SATURDAY

### Children's Story Time

Stories highlighting Asian Pacific Islander Heritage Month. For children ages 3–7. *10:30 am*

### Asian Pacific Heritage Month

Tongan tapa cloth creation. See page 4 for information. *noon–4 pm; (510) 637-0455; Free to public; Oakland Asian Cultural Center.*

## 10 MONDAY

### Finding Aliens

Benjamin Dean lecture with Seth Shostak, Ph.D. See page 3 for information. See below for tickets. Tickets can also be purchased at the door, when available. *7:30–9 pm; \$3; JCCSF*

## 14 FRIDAY

### Nineteenth Annual Academy Ball

Disguise Your Eyes: A Masked Ball at City Hall. See page 7 for information. See below for tickets. *6:30 pm–midnight; (415) 750-7222; Tickets begin at \$400; City Hall, San Francisco.*

## 15 SATURDAY

### Children's Story Time

Stories highlighting Asian Pacific Islander Heritage Month. For children ages 3–7. *10:30 am*

### Asian Pacific Heritage Month

Featuring the Cook Islands Maori Cultural Society. See page 4 for information. *4 pm; (510) 637-0455; Free to public; Oakland Asian Cultural Center.*

## 17 MONDAY

### Empire of the Ants

Members' lecture with Brian Fisher, Ph.D. See page 3 for information. See below for tickets or at the door. *2 & 7:30 pm; Free to members, \$4 Zeum members, \$8 non-members; Zeum Theater.*

## 22 SATURDAY

### Children's Story Time

Stories highlighting Asian Pacific Islander Heritage Month. For children ages 3–7. *10:30 am*

## 23 SUNDAY

### Spring Bird Watching

See April 9 for description. *9–11:30 am; Free; Meet at the corner of Middle Drive Road and 9th Avenue. Rain cancels program.*

## 26 WEDNESDAY

### Conversations at the Herbst Theatre

Featuring Diane Ackerman. See page 3 for details. To order tickets, call City Box Office at (415) 392-4400 or visit [www.cityboxoffice.com](http://www.cityboxoffice.com). *8 pm; \$16 members, \$18 non-members; Herbst Theatre.*

## 29 SATURDAY

### Children's Story Time

Stories highlighting Asian Pacific Islander Heritage Month. For children ages 3–7. *10:30 am*

## 30 SUNDAY

### Family Discovery Hike

See April 18 for description. *10 am–noon; Free; Meet at the corner of Middle Drive Road and 9th Avenue. Rain cancels program.*

## ORDER FORM

### LECTURES & EVENTS

Mars-like Soils in the Atacama Desert  
Monday, April 12 at the JCCSF

QTY MEMBERS/ QTY ZEUM MEMB./ QTY NON-MEMB. TOTAL

x\$3

The Earth Moved  
Monday, April 19 at Zeum

FREE

x\$4

Finding Aliens  
Monday, May 10 at the JCCSF

x\$3

19th Annual Academy Ball  
Friday, May 14 at City Hall

x\$400

Empire of the Ants  
Monday, May 17 at Zeum

FREE

x\$4

**DONATIONS**  Yes, I would like to support the Academy with a donation. \$ \_\_\_\_\_

**TOTAL PAYMENT ENCLOSED** \$ \_\_\_\_\_

Check (made payable to CAS)

Visa     Mastercard     American Express (\$10 minimum on credit card orders)

Card Number \_\_\_\_\_

Exp. Date \_\_\_\_\_

### FIELD TRIPS, JUNIOR ACADEMY & WORKSHOPS

To register for courses and other educational offerings, see page 2.

### I WOULD LIKE INFORMATION ON:

receiving *Discovery*, the Academy's magazine of philanthropy.

giving a Gift Membership.

making a gift from my will or living trust.

giving from retirement plan proceeds.

the benefits of life income plans.

providing for the Academy in my will or other estate plan.

becoming an Eastwood Associate.

YOUR NAME: \_\_\_\_\_ Phone: \_\_\_\_\_

Address: \_\_\_\_\_ Member #: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

E-mail: \_\_\_\_\_

**i** Mail payment and order form to: Membership Office, Ticket Services, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118. Include a self-addressed, stamped envelope for each series to which you subscribe. No refunds/exchanges. To order by phone call (415) 750-7145.

# Academy Travel 2004

**IN THE WAKE OF LEWIS & CLARK**  
**September 29–October 5, 2004**  
Aboard the *Sea Bird*  
With Carol Tang



Canyon, more than 450 miles upstream on the Snake River. Frequent forays to explore remote side canyons will be made in Zodiac landing craft, and Carol Tang, Ph.D., and other naturalists and historians will share their enthusiasm for this area with slide presentations and informal talks. **Cost: \$2,390 to \$3,750 per person (based on double occupancy).**

The Columbia and Snake Rivers are among America's great and historic waterways. The Columbia was key to the opening of the West, providing a riverine path for the epic explorations of Lewis and Clark. You will sail this beautiful, natural highway through arid plateaus, forested mountains, and fertile farmland to Hell's

In the past 400 years, the city of Churchill in the Canadian province of Manitoba has been the site of a Hudson Bay trading post, a British fort, an astronomical observatory, a rocket range, and a military installation. Today the town is the undisputed "polar bear capital of the world." In the summer, ice covering the shallow waters of the Hudson Bay melts, making ringed seals (the primary polar bear food) hard to catch and forcing polar bears ashore. After wandering inland and feeding on vegetation all summer, they move north toward the newly-forming ice. In late October, polar bears congregate in Churchill, waiting for the ice pack to form so they can once again hunt seals. Meg Burke, Ph.D.

will be your guide. Specially designed tundra buggies keep you high and safe, yet allow maximum visibility and photographic opportunities during your time amongst the bears.

**Cost: \$3,195 per person (based on double occupancy).**

**THE POLAR BEARS OF CHURCHILL**  
**November 1–7, 2004**  
With Meg Burke



**i** For brochures or further information, please contact the Academy Travel Office at (800) 853-9372 or (650) 365-6244 or e-mail [calacademy@hcptravel.com](mailto:calacademy@hcptravel.com).

## Third Generation Corals Open at 875 Howard Street



PHOTO: TOM TUCKER

Coral biologist Bart Shepherd asexually culturing coral "buds."

In the 1980s, when the practice of culturing live corals was in its infancy, the Academy embarked on a colorful but complicated project – designing San Francisco's first Coral Reef exhibit. Under the leadership of Academy Director Frank Talbot and Steinhart Aquarium Director John McCosker, aquarium employees followed consulting advice from leaders in the field of coral cultivation to create a coral reef display that relied on "algal scrubber trays" to remove nitrogenous waste from the tank. The exhibit opened in 1988 with great anticipation and fanfare.

Stocked with corals that had been confiscated from illegal collections by the United States Fish and Wildlife Service, as well as bony fishes and sharks, the exhibit was an immediate success with our public and colleagues, but it still had a few kinks that needed to be worked out.

Under current Steinhart Aquarium Director Robert Jenkins, many refinements have been made to our 6,000-gallon Coral Reef exhibit, including the addition of protein skimmers, calcium reactors, an anaerobic sand layer above a plenum for complete denitrification of waste, removal of the heavy-waste-generating sharks, elimination of the "algal scrubbers," and increased water recirculation. The success of this modified system has led the Academy's exhibit designers to propose a 225,000-gallon living coral exhibit for the new Academy, which will open in Golden Gate Park in 2008.

In the meantime, the Academy will continue to culture and grow out corals, experiment with materials, and refine our husbandry techniques by opening our temporary Howard Street facility with a 20,000-gallon coral reef tank. The display will be 20 feet deep, with concave, convex, and flat acrylic viewing windows. Our corals will be placed on adjustable shelves mounted on the tank walls at different depths. Stadium light fixtures from Germany and the United States will focus near daylight conditions to the bottom of the tank.

Our coral biologists will dive and record light levels, toxic releases by leather corals, water flow, and water chemistry as they experiment with our corals' optimal growth parameters. With this information in hand, our public can look forward to the opening of one of the world's most spectacular aquaria of living corals at the new Academy in 2008.

— Tom Tucker, Aquarium Curator

### Volunteer Profile

## Meeting New Challenges at Howard Street

The Biodiversity Resource Center (BRC), a treasure trove of resources for teachers, students, and the curious visitor, opened in January 1991. Over 300 volunteers have worked at the BRC since that time, and Dan Froloff is one of those volunteers. A retired teacher, Dan admits to more than a passing interest in the natural sciences, but after three years at the Academy, he has developed "a mind-grabbing fascination" with the natural world. "Wow! I've never heard of that," is his mantra whenever he answers reference questions ranging from the simplistic to the esoteric, from the challenging to the wondrous. "In a very fundamental way, my observational skills are stronger now. Even as I walk the dog in the park I'm more aware, more focused on what I'm observing," Froloff remarks.

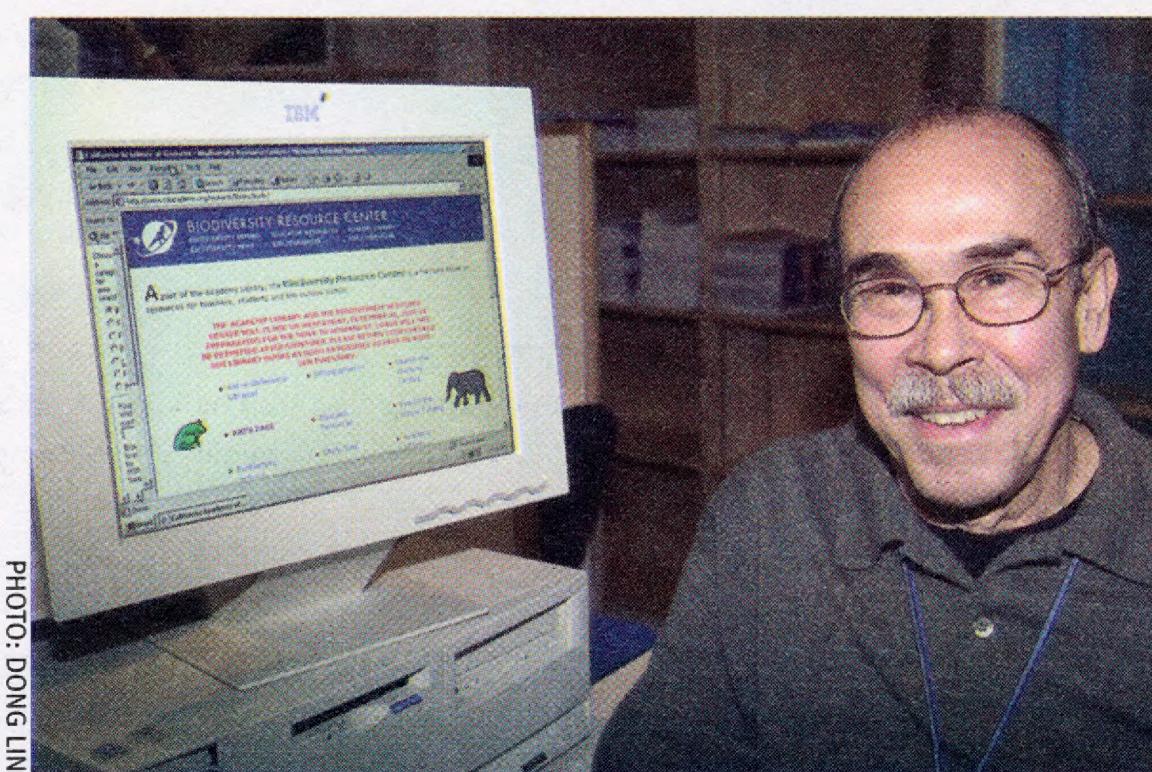
What kinds of questions do people ask? Many have questions about the identification of plants, the kinds of plants that might flourish in a Bay Area backyard garden, and the difference between native and non-native species. "Snakes, salamanders, and fish are all at the top of the list, as well as invasive species." Surprisingly, Froloff sees no trends in the nature of the questions asked, but finds great satisfaction in being able to respond to most requests. Among his other

duties, Froloff also takes pleasure in creating bibliographies, learning new computer skills, and producing children's activity projects. All in a day's work!

At 875 Howard Street, the Naturalist Center will provide the same services as the BRC. However, in addition to the volunteers' usual tasks, they will reproduce behind-the-scenes activities for the public, help with school projects and hobbies, and pilot program activities that will include "investigating unknowns" like digging out fossils, dissecting, and doing "real" science. Froloff, undaunted by all these challenges, is looking forward to expanding his volunteer career as he continues to work alongside his "incredibly warm and welcoming" colleagues.

Without missing a beat, he says with enthusiasm and delight, "It sounds like it is going to be fun!"

— Rosalind Henning, Volunteer Services Manager



Volunteer Dan Froloff is looking forward to new challenges at 875 Howard Street.

**i** If you are interested in working in the Naturalist Center or becoming an Academy Volunteer, please call (415) 750-7154 for more information.

# Nineteenth Annual Academy Ball



PHOTO: DONG LIN

Architect Renzo Piano with Loree Lee Harper at the 2003 Academy Ball.

On Friday, May 14, 2004, the Academy will celebrate its Nineteenth Annual Academy Ball, *Disguise Your Eyes: A Masked Ball at City Hall*, from 6:30 pm to midnight. Since the Academy in Golden Gate Park is undergoing a comprehensive rebuilding project, the event will be located at City Hall, 1 Dr. Carlton B. Goodlett Place, San Francisco. City Hall is located near the Academy's temporary facility at 875 Howard Street. Ticket prices for this gala fundraising event begin at \$400 per person.

Cocktails, dinner, dancing, and entertainment, including Swan Oyster Depot and catering by Dan McCall, will make this masked ball truly memorable. Valet parking. Black tie. Masks optional.

Fabulous masks may be purchased at

Mask Italia at a 15% discount for Academy Ball-goers. Visit their Web site at [www.maskitalia.com](http://www.maskitalia.com) or their store located at the top level at 2176 Chestnut Street, San Francisco. Be sure to mention the Academy Ball hosted by the California Academy of Sciences to get your discount.

**i** For more information, please call Deidre Kernan at (415) 750-7222 or e-mail [dkernan@calacademy.org](mailto:dkernan@calacademy.org).

## In Retrospect

Following the "Great Disaster" of April 18, 1906, the Academy was one of the many organizations seeking new quarters. By the end of the month, a business office was rented at 1806 Post Street. Regular members' meetings did not resume until the Academy settled into somewhat more spacious quarters at 1812 Gough Street (shown here). When the 1905–1906 Galápagos Expedition returned in November with a ship full of new specimens, we were already out of storage space and had to partition off a section of our burned out museum building on Market Street (which actually still had some sturdy parts) to hold our precious acquisitions.

By 1910, we were scattered in at least three different locations around the city, and Director Loomis brought the staff and collections back together by leasing one entire floor of the Security Building at 343 Sansome Street.

The minutes of the board meetings of the time reflect move-related activities similar to those happening now: the purchase of packing materials and hire of skilled workers to assist. Loomis was commended by the Board of Trustees when the move was completed "without injury to a specimen." We hope to be worthy of a similar commendation at the end of this year.

— Michele Wellck,  
Academy Archivist

References: Leviton and Aldrich's *California Academy of Sciences 1853–1906* and original handwritten meeting minutes in the Academy Archives.



The Academy's Temporary Headquarters, circa June 1906.

PHOTO: SPECIAL COLLECTIONS / CAS LIBRARY (N2113)

## Corporation and Foundation Support

7

The **Lannan Foundation** of Santa Fe, New Mexico has awarded the Academy \$172,800 to support the Academy exhibit *Arctic National Wildlife Refuge: Seasons of Life and Land* as it travels to other institutions. The Academy is pleased that the stunning photographs of Subhankar Banerjee will reach audiences around the country.

The California Academy of Sciences is delighted to welcome **H & N Foods International** as a Corporate Partner, and appreciates the renewal of a Corporate Partnership with **Vector Laboratories**.

The Academy is grateful for recent support from the following foundations: the **CDM Foundation**, the **Henry I. Pien Foundation**, the **William G. Gilmore Foundation**, the **G.H.C. Meyer Foundation**, the **Mary A. Crocker Trust**, and **Lisa and Douglas Goldman Fund**, all for general operations.

The Academy is delighted to receive a \$25,000 unrestricted grant from the **Frank A. Campini Foundation**, \$25,000 from the **Eva Benson Buck Charitable Trust**, \$15,000 from the **JEC Foundation**, \$10,000 from the **Ishiyama Foundation**, and \$7,500 from the **Uvas Foundation**. In addition, the Academy is grateful for the **Leakey Foundation's** generous grant for research by Academy anthropology curator and chair Nina Jablonski, Ph.D.

Thank you to all of our donors. Your support allows the Academy to fulfill its 150-year-old mission to explore and explain the natural world.

### New Donor Circle Members

November and December 2003: \$125 to \$999  
Many thanks to the following new donors  
and those who have increased  
their support of the Academy recently.

Ms. Anna M. Bagniewska  
Mrs. Sandra J. Bedell  
Mr. and Mrs. Peter E. Engel  
Ms. Veronica Espada  
Mr. Robert P. Feyer and Ms. Marsha Cohen  
Mr. and Mrs. Jonathan Heller  
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Mr. and Mrs. Terence Tracy

## Join Me In The Pool!



This month, a number of devoted Academy members will receive an income check from our Pooled Income Funds. These funds are life income financial plans that pay variable rates and enable participants to convert appreciated equities with no capital gains liability. Why not join them?

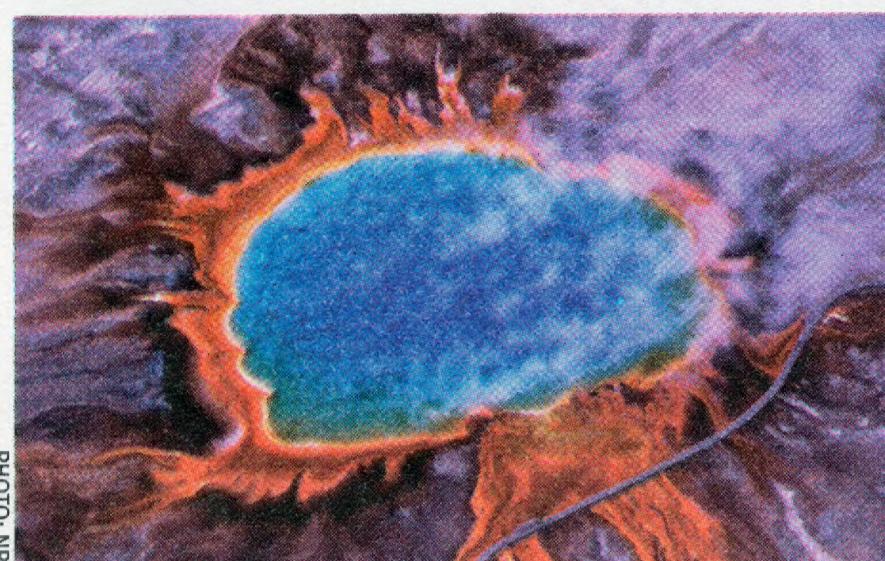
**i** For information, contact Louise Gregory at (415) 750-7354 or via e-mail at [lgrey@calacademy.org](mailto:lgrey@calacademy.org) and ask for Pooled Income Fund information. You may also fill out and return the order form on page 5.

A vivid memory for longtime Academy visitors is the seal ponds. One member recalls, "I am filled with fond memories of the Academy. My first acquaintance with California quail and little bats was from my parents' arms, as I peered at the small dioramas of North American Hall. I also recall peeking through the railing at seals and sea lions in the pool in front of Steinhart."

# Exhibits Opening at 875 Howard Street

## Astrobiology Exhibit Explores Extreme Life Forms

What is life? How do we study it? Where is it found on Earth? And does it exist elsewhere in the Universe? These are the questions that are at the heart of astrobiology – an exciting new scientific discipline that combines the traditional



**PHOTO: SNS**  
Hot springs such as this host a wide variety of life forms and help guide our search for life in other extreme environments on Earth and beyond.

fields of astronomy, biology, geology, chemistry, and physics to address a vast topic: the study of life in the Universe. The Academy is delving into this compelling new field by creating an exhibit for its 875 Howard Street location titled *Astrobiology: Life in the Extreme*.

To identify the types of environments that would be

capable of supporting life beyond our own planet, astrobiologists must study the limits of life here on Earth. They do this by researching extreme environments, such as thermal springs and hydrothermal vents (geysers on the ocean floor), that host hardy living organisms. Both of these types of extreme environments will be explored in the Academy's new *Astrobiology* exhibit.

Thermal springs, which are formed when hot water percolates up to the Earth's surface, often house unusual organisms that possess special adaptations for dealing with the heat. These springs may represent the types of conditions that were common on Earth when life first originated and diversified. Mars may have supported similar types of environments during the early part of its history or even more recently as new discoveries suggest.

In 1977, scientists learned that hydrothermal vents also host specially adapted life forms. The organisms that live near hydrothermal vents, including clams, crabs, and barnacles, must tolerate high water pressure, hot temperatures, and darkness. Without light or photosynthesis, they must rely on chemical energy to fuel their life processes. Some scientists believe that Europa, one of Jupiter's moons, may support hydrothermal vents.

In addition to the displays dedicated to these two extreme environments, *Astrobiology* will include interactive components for children, such as a guessing game about temperatures, and a Visualization Lab, where visitors will get to preview technology and content that are under consideration for the new Morrison Planetarium, scheduled to open in the new Academy in Golden Gate Park in 2008.

## Finding Your Way to 875 Howard Street

### Driving Directions

#### 80 West

Take I-80 west to the Harrison Street exit. Continue straight past Harrison to Howard Street. Take a left at Howard Street. 875 Howard Street will be on your left, between 4th and 5th Streets.

#### 101 North

Take 101 north toward I-80 Bay Bridge/Oakland. Exit 7th Street. Turn left onto 7th Street, and then turn right onto Mission Street. Continue for three blocks. Take a right at 4th Street and take another right onto Howard Street. 875 Howard Street will be on your left, between 4th and 5th Streets.

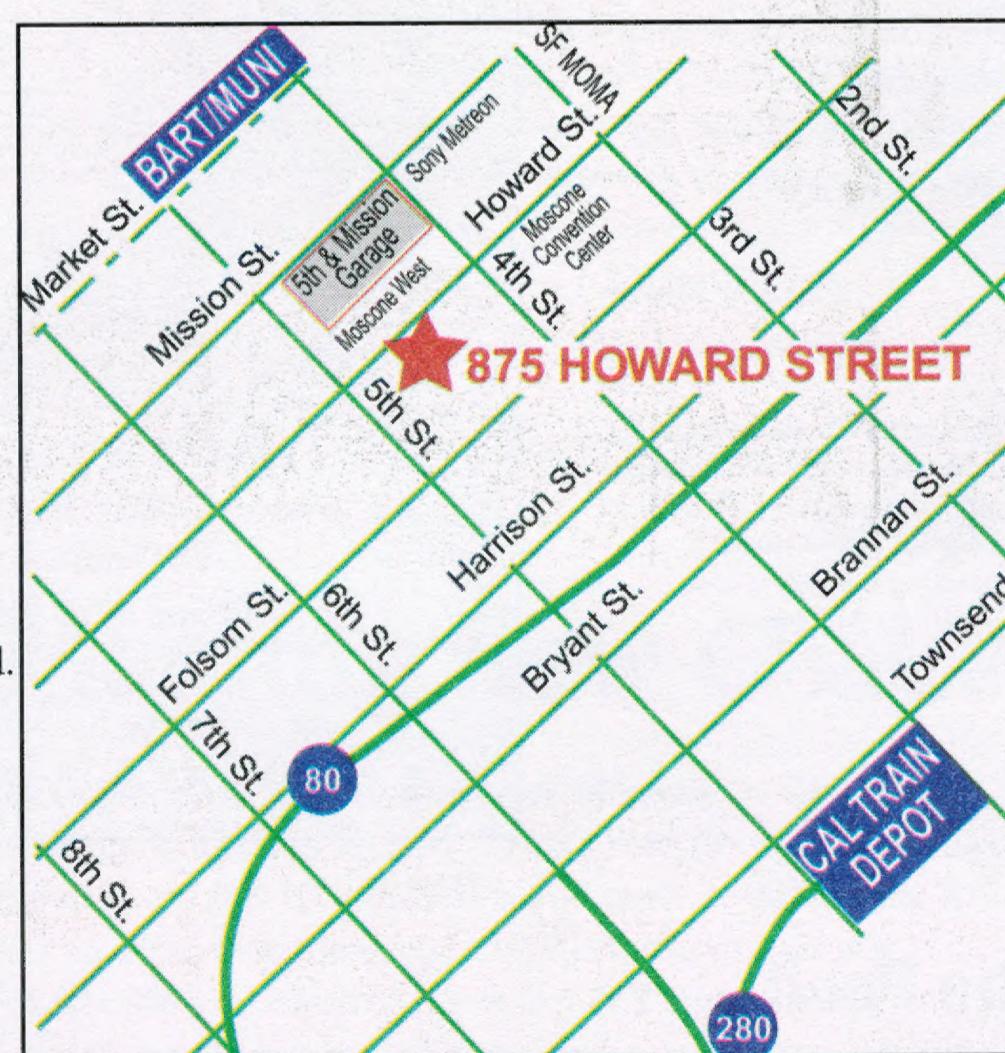
#### 280 North

Take 280 north into San Francisco. Exit Sixth Street. Continue down Sixth Street to Mission Street. Turn right onto Mission Street and head down to 4th Street. Take a right at 4th and take another right onto Howard Street. 875 Howard Street will be on your left, between 4th and 5th Streets.

#### 101 South

Take the Golden Gate Bridge south into San Francisco. Exit on Lombard. Continue on Lombard. Turn right on Van Ness. Turn left onto O'Farrell. Turn Right onto Stockton. Stockton crosses Market Street and becomes 4th Street. Turn right onto Howard Street. 875 Howard Street will be on your left, between 4th and 5th Streets.

**To continue to the 5th and Mission Garage, continue down Howard to 5th Street. Turn right. Turn right onto Mission and enter the garage midway down the block on your right.**



## Spots for Tots



### Nature Nest

A Hands-On Experience for Young Children

The second floor of the Academy's Howard Street building will include special spaces designed for young children, including **Nature Nest**

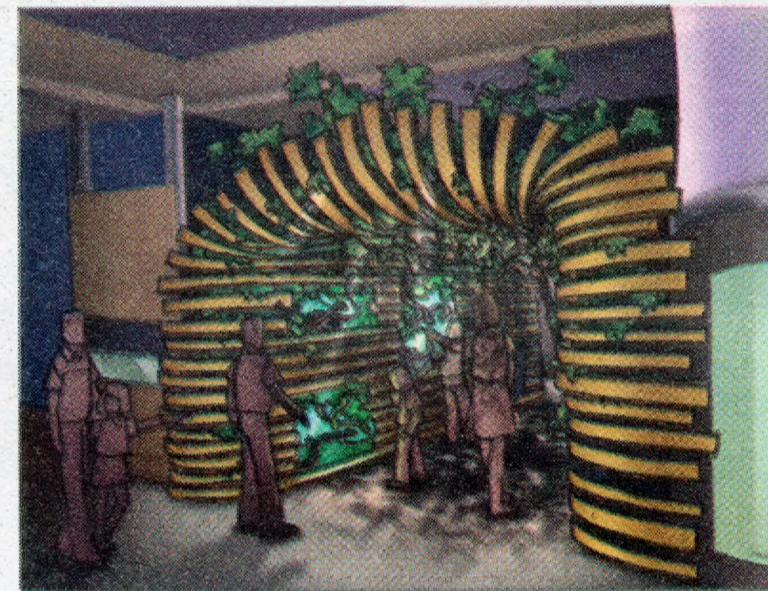
– an interactive learning and play area for small scientists-in-training. **Nature Nest** will include a “landscape” play area that will be stocked with costumes, puppets, model animals, building materials and more, allowing pre-school children to transform and design their garden playground. The space will also include live animal tanks and a water table. Gather on the landscape steps for Children's Story Time to be held every Saturday morning at 10:30 am. Not far away, the **Naturalist Center** will provide additional activities for children, including educational activities that range from fossil excavations to owl pellet dissections. While young visitors enjoy the science-based programming at the Naturalist Center, adults can take advantage of the center's reference collections of natural history specimens and library materials.



### Naturalist Center

Discover Biodiversity

## SSssnake Alley



They're scaly, slinky, and slithery, and at the Academy's new Howard Street location, they'll line the walls of a winding passageway called **SSssnake Alley**. Steinhart residents that formerly made their home in the Swamp, including the anaconda, African rock python, ball python, pine snake, vine snakes, California kingsnake, ground boas, and emerald tree boas, are slated to take up residence at SSssnake Alley within

the next few weeks. Stop by and say hello to some of your favorite slithering Steinhart inhabitants when you visit us at Howard Street.

### Public Transportation

To visit via public transit, check out [www.transitinfo.org](http://www.transitinfo.org) for free trip planners and a comprehensive list of Bay Area public transit maps.

#### MUNI

Nineteen Muni lines drop off within three blocks of 875 Howard Street: 2, 3, 4, 5, 6, 7, 9, 9X, 12, 14, 14X, 16AX, 16BX, 21, 30, 31, 38, 38L, 45, 66, 71, F, J, K, L, M, N.

#### CABLE CARS

See directions below. Exit at Powell & Hyde or Powell & Mason.

#### BART

See directions below. Exit at the Powell Street Station.

**Directions from buses, historic street cars and cable cars that exit at Powell Street, and from the BART and Muni Powell Street Station: walk northeast on Market to 4th Street. Turn right onto 4th Street. Continue for two blocks. Turn right onto Howard Street. 875 Howard is on the left.**

#### AC TRANSIT

Twenty-two bus lines stop at the San Francisco Transbay Terminal. The Transbay Terminal is located between Fremont and First streets on Mission. From the Transbay Terminal, walk six blocks down Mission to 4th Street turn left, walk one block, turn right onto Howard Street. 875 Howard Street is on the left. B, C, CB, E, F, FS, G, H, L, LA, NL, NX, NX3, NX4, O, OX, P, S, SA, SB, V, W

#### GG TRANSIT

Eight Golden Gate Transit buses stop within two blocks of 875 Howard Street on Mission Street: 10, 20, 50, 60, 70, 80, 90, 93.

#### FERRY

The Larkspur, Sausalito, Tiburon, Oakland, Vallejo Baylink and Alameda ferries all drop passengers off at the Ferry Building at the end of Market Street and the Embarcadero. Visitors may ride BART or Muni to the Powell Street Station or walk twelve blocks to 875 Howard Street.

#### CALTRAIN

Caltrain runs between Gilroy and San Francisco. It is a public transit alternative to driving to 875 Howard Street from the Peninsula. There is at least one stop in every major city along the Peninsula. Conveniently, the San Francisco station is located six blocks from 875 Howard Street. From the 4th and King Street station, exit onto 4th Street. Turn right and continue on 4th Street for five blocks. Turn left onto Howard Street. 875 Howard Street is on the left.

#### SAMTRANS

SamTrans provides service from areas throughout San Mateo County to downtown San Francisco. Several buses travel to and from the Transbay terminal via Mission Street. Express busses are listed first. DX, FX, KX, MX, NX, PX, 391, 292